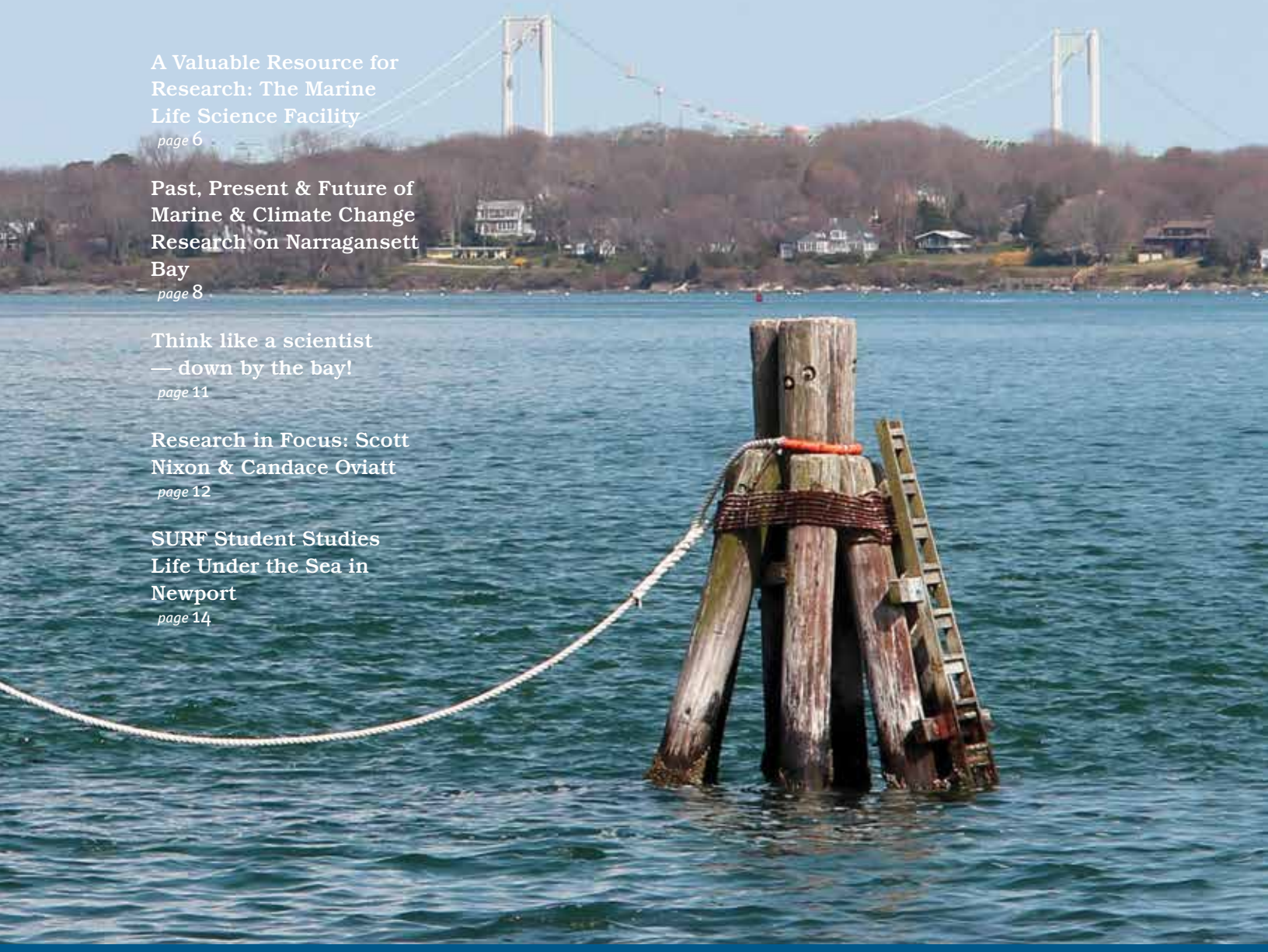
Special Issue!

THE current

research and happenings from rhode island nsf epscor | summer 2012

Down by the Bay



Rhode Island NSF EPSCoR
Experimental Program to Stimulate Competitive Research

THE current

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VISIT OUR WEBSITE
http://riepscor.org

Become a fan of Growing STEM in the Ocean State
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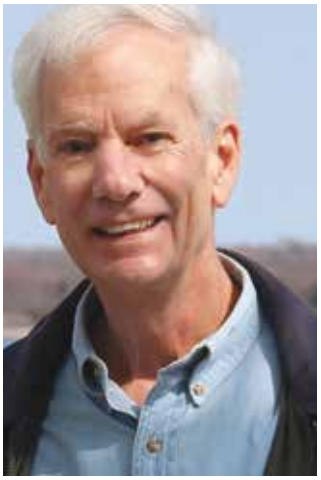
On the Cover:
Looking out toward Jamestown and the Newport Bridge from the University of Rhode Island Graduate School of Oceanography. Narragansett Bay not only a natural laboratory for research but also a critical part of Rhode Island's local environment and economy.

mission

Our Mission is to provide a platform to promote collaboration and cooperation among Rhode Island's institutions of higher education (IHE) and to enable alignment of our efforts with the needs of the state to increase research competitiveness, especially in marine life science and affiliated sciences. We believe this will improve the employment rate, provide more attractive employment opportunities, create new businesses, and preserve and strengthen our connection to Narragansett Bay, its watersheds, Rhode Island Sound, and the Atlantic Ocean.

NSF

tribute: scott nixon



Professor Scott Nixon died unexpectedly May 21, 2012. The depth of grief in our community over his loss is testimony to the supportive, creative, quirky, reverently irreverent, brilliant person who won many awards nationally and internationally and who championed the library and his students and colleagues locally. His vision as Director of Rhode Island Sea Grant (1984-2000), his service on the National Research Council's Ocean Studies Board, and his service on countless committees, including the EPSCoR Steering Committee, all testify to his commitment to the marine and coastal environment. This was surpassed only by his commitment as a mentor to his students. This is a nod to his students: continue to question dogma and to care. Tutus a morte.

facilities

Rhode Island NSF EPSCoR supports three core research facilities to help discover the effect of climate variability on marine life. Each facility is open to researchers and students statewide. An inventory of available equipment and expertise can be found at www.riepscor.org.

Proteomics Center, Brown University, Providence

Instrumentation for the physical characterization of biological macromolecules

Genomics & Sequencing Center, URI, Kingston

Instrumentation for robotic sample preparation, fragment analysis, rt-qPCR, bioanalyzer

Marine Life Science Facility URI, Narragansett

Flowing seawater with temperature control, instrumentation for preparing organisms for analyses, BD Influx Flow Cytometer

Speaking at an America's Cup dinner in Newport, Rhode Island, in 1961, President Kennedy said, "We are tied to the ocean. And when we go back to the sea, whether it is to sail or to watch it, we are going back from whence we came."

Rhode Islanders have always had a special bond with the ocean, and it isn't hard to see why when you're crossing the Newport Bridge, or coming home in a fishing vessel through the breakwater at Galilee, or playing with your children on the shores of our State's more than 400 miles of coastline.

As a practical matter, Rhode Island relies on Narragansett Bay and the waters offshore to provide jobs for fishing, shipbuilding, tourism, and soon, we hope, wind power. We are the Ocean State because from our earliest days we have relied on these waters and they have always supported us. But in Rhode Island, and around the world, the tide is literally changing.

Sea level is rising, water temperatures are increasing, and ocean pH is dropping as a result of climate change. Ocean and coastal ecosystems already stressed by chemical and nutrient pollution, marine debris, energy extraction, overfishing and overdevelopment now also struggle to deal with these added, insidious stressors. The result is nothing short of major ecosystem shifts.

In the face of all these changes, we need to understand what is happening in our oceans. Now, more than ever before, we should be investing heavily in ocean exploration, ocean monitoring and baseline data collection, as well as fisheries science and water quality monitoring to support the fishing and tourism industries.

Rhode Island NSF EPSCoR is rising to the challenge. For instance, NSF EPSCoR is filling the knowledge gap, investing in cutting-edge research to understand the responses of marine organisms and ecosystems to climate change. Rhode Island NSF EPSCoR is educating and exposing middle and high school students to science through hands-on field trips and teacher training, to inspire a new generation to be more aware of their environment and the implications of human action and inaction.

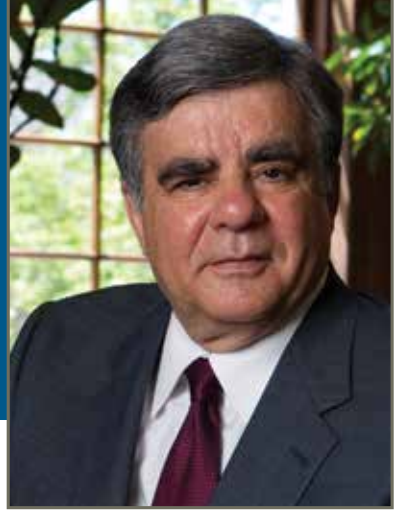
There is much to be done. That's why I was so glad that in this Congress, the National Endowment for the Oceans, which I introduced with Senator Olympia Snowe, passed the Senate as part of the Gulf of Mexico RESTORE Act. This bill would provide funding to get the National Endowment for the Oceans off the ground, so that while restoring the Gulf of Mexico in the wake of the oil spill, we can also better study and protect all of our marine and coastal ecosystems. The Endowment would fund research, like cooperative fisheries research, restoration of critical habitat, relocation of critical public infrastructure at risk from sea level rise, and planning for current and future uses of our offshore waters. I hope this legislation will pass the House, so institutions around the country that want to conduct research, restoration and planning will have more resources available to carry out their important work.

Sincerely,

Sheldon

Sheldon Whitehouse
United States Senator

Greetings from the Rhode Island EPSCoR Director



Dr. Peter Alfonso

Welcome to this special issue of The Current about Narragansett Bay.

Narragansett Bay is one of the first six estuaries recognized by the U.S. EPA's National Estuary Program as an estuary of national significance. The Program was established in 1987 by Rhode Island's Senator John Chafee. Rhode Island's Senator Sheldon Whitehouse led the re-authorization of the Program last year. The Bay is a nursery ground for many kinds of fish, a critical component of our seafood industry, and a recreational and economic driver here in the Ocean State. The Bay drives our tourism industry and the Bay's good health is what made it possible for Newport to win the final stop of the 2012 America's Cup World Series – a large honor for Rhode Island. Thousands of people will visit us in late June for the event and get the chance to experience Narragansett Bay first hand. The continued good health of Narragansett Bay will depend on the work of local scientists, educators, and policy makers.

The state understands the importance of keeping Narragansett Bay healthy. Its Comprehensive Conservation and Management Plan (CCMP) requires us to consider risks to the estuary caused by climate variability and to identify measures to mitigate those risks. Those are the issues investigated with funding through the National Science Foundations' Experimental Program to Stimulate Competitive Research (NSF EPSCoR).

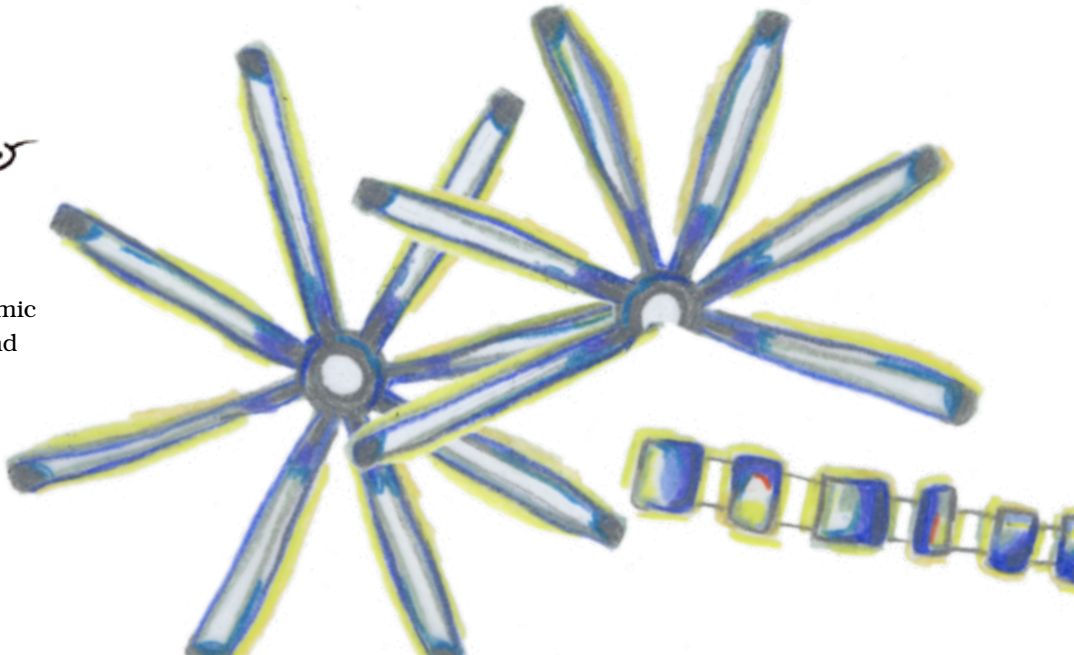
Without cost sharing by the state, we would not be recipients of the $20M Collaborative Agreement with NSF to investigate the impact of climate on marine life in the Bay. This is the sixth year of the Rhode Island Research Alliance Collaborative Grants Program. This program provides the cost share for NSF EPSCoR and has given $6.5 million in seed funding to 46 collaborative teams in the first five years. Each team includes at least one local company. Their initial investment has already led to $36 million in follow on funding. This year, another $1.4 million investment will be made by investing in 8 teams, many of them with marine and climate change related projects.

Thank you and enjoy.

Sincerely,

Peter Alfonso

Peter Alfonso, Ph.D.
Rhode Island State EPSCoR Director
Vice President for Research and Economic Development, University of Rhode Island



Observations from the Co-Project Investigators

JENNIFER SPECKER, UNIVERSITY OF RHODE ISLAND

Scholarship occurs through independent effort and within a social context. This is to welcome all the courageous undergraduates and graduate students accepted to our summer research programs. Summer 2012 will be NSF EPSCoR's biggest year to date. An important goal of ours is to continue to build the number of opportunities for students to experience the hard work and joy of discovery.

EDWARD HAWROT, BROWN UNIVERSITY

NSF EPSCoR greatly improved the state's infrastructure for research in the areas of Proteomics and Genomics. Two other resources available to NSF EPSCoR investigators are the Center for Computation and Visualization (CCV) and the Institute for Computational and Experimental Research in Mathematics (ICERM). As the investigators and their students build collaborations, these advanced research centers will be of incredible usefulness to gaining knowledge about complex environmental and health systems.

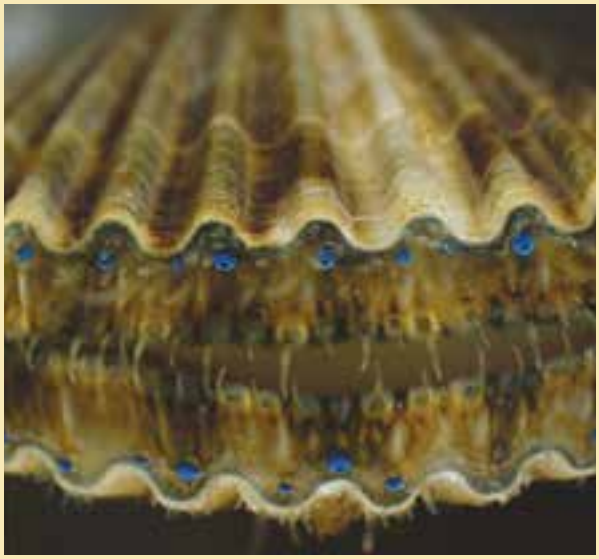
MARY SULLIVAN, RHODE ISLAND COLLEGE

The Rhode Island STEM Center at Rhode Island College brought together 120 leaders from business, education, and government on May 4, 2012 for the second state STEM Conference - EmpoweRIng the Future. The NSF EPSCoR Academy was featured in the session focused on "After-School STEM Programs: Gaining an Edge." Academy Director Phillip Veillette facilitated the session and Tim Pelletier from CCRI presented Building Inclusive STEM Experiences in Marine Life Science.

CHARLE CANNON, RHODE ISLAND SCHOOL OF DESIGN

Collaboration is central to the Rhode Island School of Design's participation in Rhode Island EPSCoR. We see our role as artists and designers to apply our creativity not only to help communicate science, but to help do science. Hosting a scientist-in-residence has helped us to be even more inventive in our art+design+science collaborations with other scientists and institutions. To see what RISD and EPSCoR researchers are working on and to join a larger conversation visit http://expspace.risd.edu/.

news



Kate Markey's award-winning scallop eye photo.

Movers and shakers

Congratulations to Kate Markey for winning an honorable mention in the 2011 Olympus BioScapes Digital Imaging Competition! Her photo of scallop eyes caught the eyes of the international photo competition and the picture was published in the December issue of Scientific American. Markey is a technician in the Aquatic Diagnostic Laboratory at Roger Williams University.

We've welcomed Malcolm McFarland as a technician for the new Flow Cytometer at the Marine Life Science Facility. McFarland is also a PhD candidate at the URI Graduate School of Oceanography studying the bio-optical properties of diatoms and how they relate to growth, distribution, and phylogeny of species.

A Valuable Resource for Research: The Marine Life Science Facility

By: Sara MacSorley

Ed Baker, facilities manager, describes the importance of filter feeders to visitors.

The NSF EPSCoR-supported Marine Life Science Facility is located at the interface of Narragansett Bay and Rhode Island Sound. This unique location allows for flowing seawater from the Bay to be pumped through the wet labs – a huge advantage for performing marine research.

Researchers have the choice of chilled, heated, filtered, or raw seawater. They can also adjust the salinity per tank. Flexibility is key for scientists to perform research with marine life from different parts of the world. The epitome of that idea lies within our environmental chambers. Scientists can mimic temperature and light cycles of marine environments – from the poles to the tropics.

Researchers and students collect samples at sea from as far away as the Antarctic Ocean and bring them back to the Marine Life Science Facility to rear and maintain. You can also regularly find local species from Narragansett Bay in the Aquarium. Student groups come through to see the dogfish sharks, winter flounder, sea squirts, various bivalves, and colorful lobsters.

The Marine Life Science Facility is home to a new Marine Molecular Ecology Lab. The Molecular Lab has marine-optimized equipment available for scientists to perform cutting-edge molecular techniques.

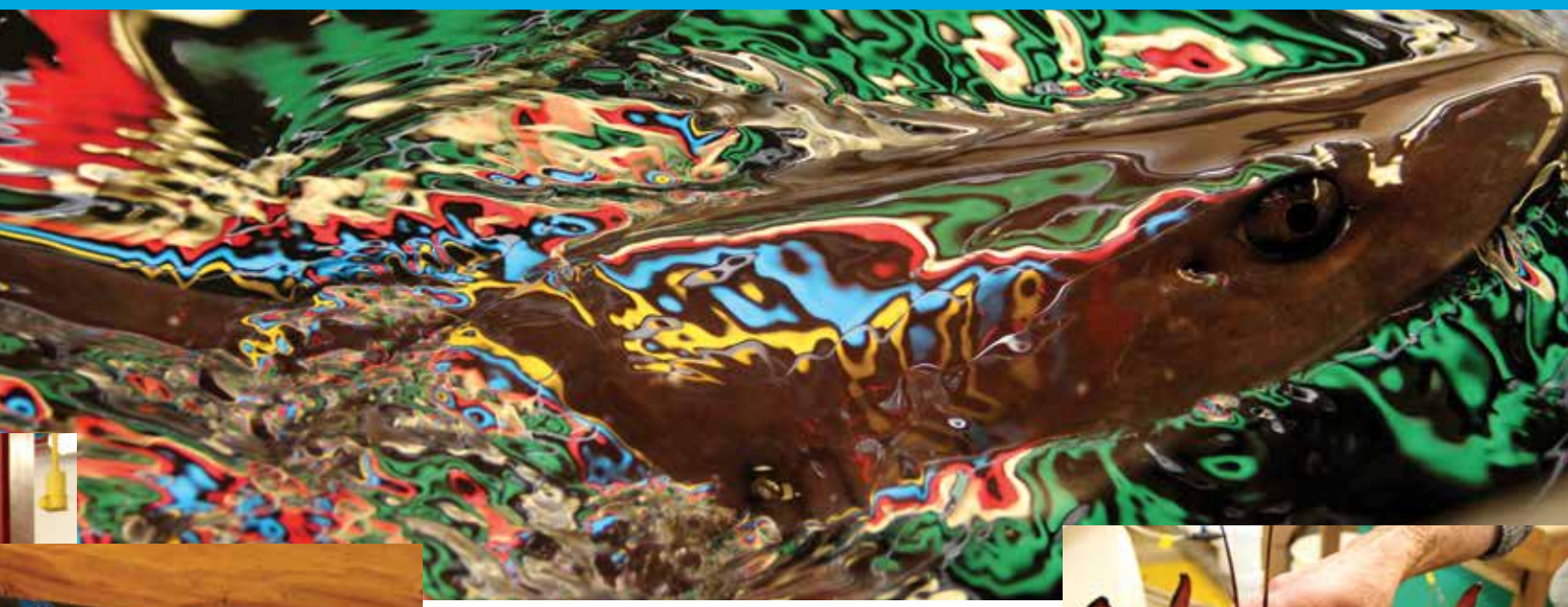
Projects have included restoration of eelgrass, studies of disease resistance in oysters, mechanisms of jaw movement in sharks, molecular ecology of zooplankton, and effects of ocean acidification on food webs.

The Facility has a fantastic staff that keeps things running smoothly. Ed Baker manages the flowing seawater and environmental chambers and Andrea Drzewianowski manages the Molecular Lab equipment. Both can be found talking to students and visitors about marine science and climate change research. Ed is a great storyteller and has a strong knowledge of the issues surrounding the health of Narragansett Bay.

Andrea has taken a recent interest in education and is heavily involved in our Hands-on Science Experiences where she teaches students about the importance of phytoplankton in the Bay *(See Hands-on Science, page 11).*

Malcolm McFarland just joined the team as a technician for our new BD Influx Flow Cytometer. This piece of equipment analyzes and sorts individual cells by measuring light scatter and fluorescence at multiple wavelengths. The machine can sort up to six populations of a wide variety of cell sizes at the same time. It can be used to study the distribution, abundance, physiological characteristics of cells over space and time, cellular biochemical processes and gene expression using fluorescent molecular probes, and, importantly to climate change research, the response of cells and communities to changing environmental conditions. Malcolm is a great asset and a 'plankton pro' when it comes to Narragansett Bay.

Another new piece of equipment is the FlowCam. The FlowCam images individual particles as they move through a glass flowcell. Multiple flowcells



This unique location allows for flowing seawater from the Bay to be pumped through the wet labs — a huge advantage for performing marine research.

Student groups come through to see the dogfish sharks, winter flounder, sea squirts, various bivalves, and colorful lobsters.

and magnification objectives allow for the visualization of a wide range of particles (2µm-2mm). Twenty-six parameters can be used to classify and identify what is seen. Current applications include looking at phytoplankton samples from Narragansett Bay and cell counts of cultures.

Next year, we plan on setting up an NSF EPSCoR Visualization Lab at the Marine Life Science Facility. Visualization tools and resources will help local scientists to better understand complex data sets and better communicate the importance of their research to the local community.

Remember, the Facility is open to researchers and students around the state of Rhode Island and beyond. Here are a few other pieces of equipment available at the Marine Life Science Facility.

For a complete list of available equipment or to set up a visit, please visit www.riepscor.org.

MARINE LIFE SCIENCE FACILITY RESOURCES

- Flowing seawater - whole, heated, chilled, filtered
- Tank Space (inside and outside)
- Environmental Chambers and Incubators
- Sample Preparation Equipment - Filtration, homoginization, sonification
- Molecular Equipment - Nanodrop, Quibit, PCR machine, QPCR machine
- Visualization Equipment - Microscopes, digital camera
- BD Influx cell sorting flow Cytometer
- Flow Cam
- Fluorescence Induction Relaxation Fluorometer (FIRe)
- Membrane Inlet Mass Spectrometer
- Lachat Nutrient Autoanalyzer
- Spectramax Plate Reader (Absorbance, Fluorescence, Luminescence)
- Lab Space and Basic Lab equipment
- Hand Held YSI (temp, salinity, DO, pH)

Past, Present & Future of Marine & Climate Change Research on Na

By: Emily Greenhalgh

Narragansett Bay is more than an estuary. Over two million people in 100 cities and towns live in the 1700-square mile area that makes up the Bay's watershed. The Ocean State's iconic inlet affects more than the members of the tourism and fishing industries that depend on it directly. A state so small is inherently interconnected and a potential problem in one sector can reverberate through all others. While the local importance of the Bay may not be news to Rhode Islanders, the role it plays in the health of not just the state, but also the world ecosystem, could certainly come as a surprise to many.

For decades, countless researchers from myriad institutions have been drawn to the fascinating world that lives beneath the surface of Narragansett Bay. Not surprisingly, nine colleges in Rhode Island (also NSF EPSCoR partners) currently host faculty members whose attentions and research are captured by the 197-square mile waterway.

Narragansett Bay forms a boundary between the northern ocean and the summer ocean. The strong Gulf Stream current feeds warm equatorial waters to the Bay year round, making it a border between temperate zones. "We're right at a place where it's the southern limit of the northern organisms and the northern limit of the mid-Atlantic organisms," said the late University of Rhode Island ecologist Scott Nixon. "Narragansett Bay is a place where you might expect to see climate change events being manifest early and rather strongly."

rragansett Bay

DECADES OF DATA

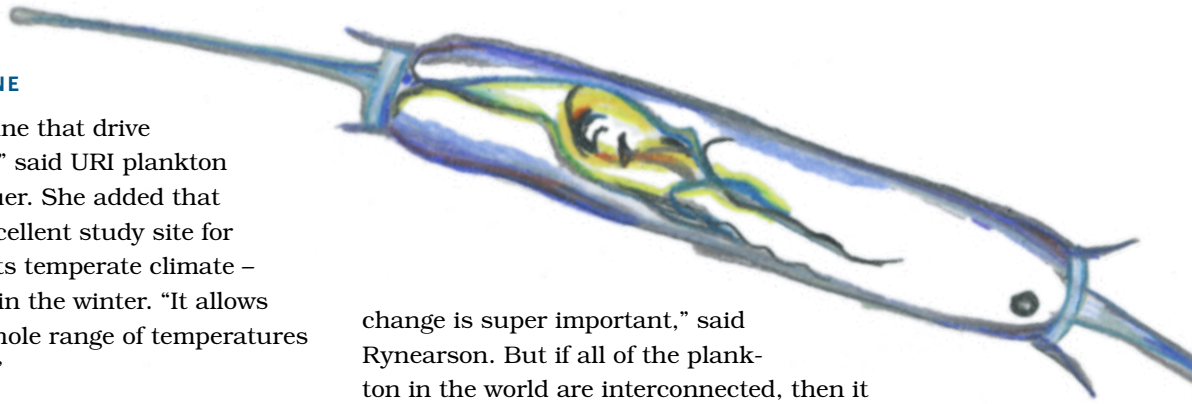
In addition to its distinctive geographical properties and the benefit of being surrounded by research institutions on all sides, Narragansett Bay offers scientists something else unique: history. The Bay is home to the longest running data time-series of its kind anywhere in the world. Since the late-1950's, researchers have gone out weekly and counted phytoplankton and documented temperature, salinity, nutrient levels, and other parameters at different monitoring stations throughout the Bay. They can add parameters whenever they need to for an experiment, but the same core tests are always run.

"The power of the time-series is that you do the same thing over and over again rather than try to change it up," said Tatiana Rynearson, associate professor of oceanography at URI's Graduate School of Oceanography. This allows researchers to see subtle changes over the course of the program's long history. It's not just scientists who are interested in the time-series data, either. Rhode Island's Department of Environmental Management (DEM) uses the long running data to help influence policy decisions.

WARMING WATERS

Climate change was a non-issue to the scientific minds around Narragansett Bay until the 1970's when they started to notice a warming trend. To date, the extended time-series observations have documented a 3.9 °F temperature increase in Narragansett Bay waters since the 1960's.

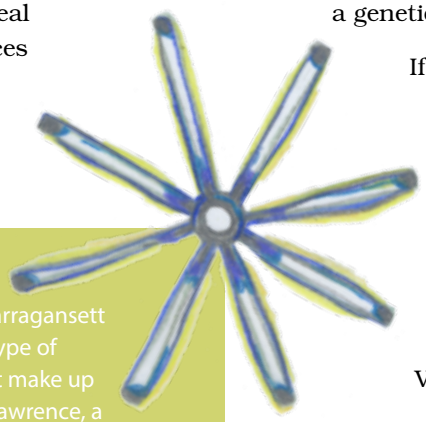
The warming temperatures have shifted the entire food web of Narragansett Bay starting with the smallest organisms. Microscopic algae are incredibly integral to the ecosystem of the Bay. For years, Narragansett Bay had important winter/spring blooms of diatoms – a chief group of single-celled algae. The Bay would literally turn green during the month of February due to the blooms. Yet with the warming, Ted Smayda, a URI researcher who has spent more than 50 years studying the Bay, saw changes, not only in the timing of the diatom blooms, but also in their function. Because less of the food is falling to the bottom of the Narragansett Bay water column, there are fewer bottom feeders in the Bay and more water column grazers.



THE GAS THAT DRIVES THE ENGINE

"Plankton are the ultimate engine that drive the carbon cycle on the planet," said URI plankton ecologist Susanne Menden-Deuer. She added that Narragansett Bay makes an excellent study site for plankton research because of its temperate climate – warm in the summer and cold in the winter. "It allows you to look at Biology over a whole range of temperatures and environmental conditions."

The way phytoplankton interconnects with the food web is another key aspect of Menden-Deuer's research. Predator-prey interactions show what, when, and how copepods are eating phytoplankton and what the grazing pressures are on the key species of interest. The organisms in the Bay have to deal with seasonal temperature differences of negative 1 °C to 25 °C and knowing different grazing rates at different temperatures allows scientists to predict how fast many of these important organisms are being eaten and how fast they're being eaten as the Earth's oceans warm.



These drawings are of diatoms found in Narragansett Bay and all over the world. Diatoms are a type of phytoplankton – the tiny ocean plants that make up the base of the marine food web. Caitlyn Lawrence, a marine research technician at the Graduate School of Oceanography provided the original photographs.

We should all remember phytoplankton once in a while. After all, one of every two breaths we take comes from the ocean.

"We live on a planet where everything is connected and even the most minute change in the remotest area has an impact on individuals lives," said Menden-Deuer. "Particularly for people in Rhode Island who depend on Narragansett Bay for tourism and fisheries. We need to understand how Narragansett Bay works and how it's going to work under future and different conditions."

OCEANIC FINGERPRINTING

Rynearson and the students in her lab are trying to address that very question conducting what she calls "CSI in the ocean." They are essentially DNA fingerprinting the plankton in Narragansett Bay and comparing them to the plankton around the world in both the northern and southern hemispheres.

"If Narragansett Bay has its own special plankton then understanding how this plankton responds to climate change is super important," said Rynearson. But if all of the plankton in the world are interconnected, then it may be good enough just to know something about any plankton species. "A lot of people are going out and doing these climate change studies and I don't know if I can extrapolate what they find to what's here," added Rynearson, demonstrating the importance of looking for a genetic link between the world's species.

If such a link exists, the possibility of collaborative research increases exponentially. Making these observations is also important because it offers scientists elsewhere the opportunity to use Bay research to their advantage. Researchers can discover how Narragansett Bay reacts to climate change compared to other important estuaries like the Chesapeake Bay in Maryland and Virginia or California's San Francisco Bay.

BIGGER FISH TO FRY

Narragansett Bay and its link to climate change is a serious draw for all sorts of scientists, as demonstrated by the scope of the NSF EPSCoR program. Dale Leavitt, an aquaculturist at Roger Williams University is focused on the development of oyster restoration efforts in the Ocean State. "After the winter we just had, it will be interesting to see if conditions such as high winter water temperatures continue into subsequent years," said Leavitt. "We are already witnessing dramatic changes in 2012 bivalve biology due to the mild winter and will be interested to see if these changes continue into the following years."

With so many research institutions and the work of Rhode Island NSF EPSCoR, Narragansett Bay fosters an inherently collaborative environment. "There are a lot of interested parties. From federal agencies like NOAA and the EPA – to state agencies – to the Narragansett Bay Estuary Program – to commercial fisherman – to DEM – to the academic community and people are trying to work together in a coordinated way to see what's going on in Narragansett Bay," said Rynearson. "That's a real strength and we have to work to make it happen, but I think it's going to help us be really successful in keeping Narragansett Bay a really productive place."

Think like a scientist — down by the bay!

Students experiencing Narragansett Bay marine life through Hands-on-Science experience at Fort Getty, Rhode Island.

"You might get your clothes wet, you might get a little cold, but you are guaranteed to have some fun while learning a thing or two about the ocean." This is what Dr. Philip Veillette, fish biologist and new Academy Director for NSF EPSCoR, and Tim Pelletier, Outreach Coordinator for NSF EPSCoR, tell school kids when they arrive at the University of Rhode Island's Narragansett Bay Campus. The students – from state middle schools and high schools – are here to be real scientists for a day and engage in the nitty-gritty business of marine biology.

The day begins with introductions to the expert marine biologists – graduate students at the School of Oceanography – who will work with the school children side-by-side. Establishing a positive relationship at the start between grad student and younger student promotes a sense of engagement and camaraderie that is carried over into the rest of the day's activities.

Regardless of the weather, students walk down to the pier, lower buckets on a rope to collect bay water, measure the temperature and salinity of the bay, then return to the aquarium or laboratory. Here, students might view the diversity of plant and animal life that is living in the very water they collected and that can only be identified under a microscope. They might measure the abundance of tiny photosynthetic plants called phytoplankton that are responsible for producing more than half of the oxygen we breathe.

Students learn that phytoplankton support, either directly or indirectly, all life in the ocean and that phytoplankton play a critical role in balancing the earth's climate. These hands-on experiences are designed to stimulate the students' interest and excitement for the sciences. The larger goals are to foster a sense of civic responsibility for protecting the marine environment and to promote an appreciation for careers in biology that serve both personal and public interests.

One of the highlights during a visit to the Bay Campus is the tour of the research aquarium - housed at the Marine Life Science Facility *(see page 6)*. The most popular marine creatures on display are undoubtedly the sharks. They have probably generated more conversation by visitors than all other critters put together.

Earlier this year, school girls from Sophia Academy in Providence came down to the Narragansett Bay Campus to participate in Hands-on-Science. A few of the day's activities saw the students not only thinking like scientists, but thinking like graphic designers and environmental policy managers for the purpose of communicating science effectively and informing discussion on climate change. The marine biology experts that day – Caitlyn Lawrence, Rossie Ennis, Andrea Drzewianoski, and Susan Gorelick – proved to be excellent women role models for the girls.

On the same day, the students from Sophia Academy got a special visit from Rhode Island Governor Lincoln Chafee. Chafee expressed to the girls the importance of research at the University of Rhode Island in protecting the future of Narragansett Bay.

"I have been introduced to a whole new world," said one student from Sophia Academy. A teacher from the same school exclaimed that "so much hands on [activity was] the best! Thanks for a wonderful opportunity!" The testimonials and smiles from the visitors to the Bay Campus let all of us at the NSF EPSCoR Academy know that we are opening young eyes to the joy and the value inherent in the marine life sciences.

Scott Nixon & Candace Oviatt

By: Emily Greenhalgh

Professors Candace Oviatt and the late Scott Nixon have trained over 65 graduate students, published nearly 275 papers in prestigious journals (25 of them in collaboration), and received national recognition for their work. They are considered two of the foremost experts on Narragansett Bay. Nixon and Oviatt call the University of Rhode Island's Graduate School of Oceanography home. The convenient location on Narragansett Bay allows them and their students to study everything from low oxygen environments to the turnover of nutrients, known as biogeochemical cycling.

"EPSCoR has been a great boon in improving our facilities," said Nixon. "The program has brought people together who hadn't previously been working together and the impact on the science has been extremely beneficial."

MERL – the Marine Environmental Research Laboratory – has been a cornerstone of Oviatt's research since it opened in 1976 thanks to a U.S. Environmental Protection Agency grant. The facility serves as an operation center and support laboratory for large experimental ecosystems. MERL houses fourteen large cylindrical enclosures roughly 6 feet wide by 18 feet deep arranged along a deck outside of the building.

The MERL tanks are "a tool which has tremendous value for answering direct questions," according to Oviatt. Scientists can use the mini-mesocosms to determine how ecosystems react to high sewage rages, salinity gradients, trace metals – like copper and iron, and acidity.

"In the early days, MERL was a really big operation. We operated on a budget of just under a million dollars a year there in the early years. So we had investigators from – I don't know – 10 or more different universities all working collaboratively here, it was very interdisciplinary," said Nixon, calling the research "really exciting stuff for its time."

While researchers still have the benefit of all of MERL's history, researchers at the two laboratories have moved on to a diverse portfolio of other groundbreaking research.

For the last five years, Oviatt's lab focused its attention on the low oxygen problem in the Bay known as "hypoxia." Her large research team – training 29 graduate students since she landed her own URI laboratory in 1969 – is currently studying how metabolism, phytoplankton, and respiration could contribute to low oxygen in the Bay and how pollution in the upper-bay can affect the lifecycles of the estuary's bottom-dwelling life.

"We expect some really dramatic changes in the next couple of years," said Oviatt.

A buoy network initiated in the late 1990's by researcher Dana Kester, gives scientists the opportunity to look at the whole system in the Bay with fast time-series measurements. In a partnership with the Department of Environmental Management, Oviatt's laboratory is part of the long-term buoy network that monitors the Bay's water quality during summer months.

Above and beyond her research, for which she received the URI Outstanding Researcher Award, Oviatt is currently an associate director of the Coastal Institute. She is also a member of the team leading the National Science Foundation's Integrated Graduate Education

Oviatt (left) and the late Nixon (right) reminiscing on the dock of the Marine Environmental Research Laboratory

"EPSCoR has been a great boon in improving our facilities," said Nixon. "The program has brought people together who hadn't previously been working together and the impact on the science has been extremely beneficial."

& Research Training program. IGERT teaches graduate students to facilitate communication between scientists and policymakers – an increasingly important skill for environmental and marine scientists.

Nixon was an authority in coastal ecology and global assessment as well as an NSF EPSCoR researcher with Oviatt. He received the Estuarine Research Federation Odum Award for lifetime achievement. He was Director of the Rhode Island Sea Grant College Program for 16 years. It was Sea Grant that drew him to the Ocean State in 1969.

"I came [to Rhode Island] because it was a really exciting opportunity to do that interdisciplinary kind of work," said Nixon. "And who wouldn't have come here? It's a beautiful place and you had an opportunity to work with some really smart people in diverse disciplines. I've always had an interdisciplinary bent – as most ecologists do. It was an amazingly exciting opportunity as a young scientist."

Currently, Nixon's lab focuses on the biogeochemical cycling of coastal ecosystems. His research led him to nearly all watershed rivers in Narragansett Bay as well as the coastal salt ponds across the south shore and out towards the outer shelf systems near Block Island sound.

"Our continuing efforts to look at different interactions between the water columns and the sediments have been a recurring theme in my lab and we've had some very exciting results for that," said Nixon. He trained 17 Master's students and 20 Ph.D. students over the years.

He and his group saw the climate change story unfolding through their biogeochemical cycling work in water sediments in Narragansett Bay and beyond. One Nixon graduate student is studying a mangrove environment in Puerto Rico and one student is working in Egypt.

Fortunately for the rest of the student population, Nixon and Oviatt didn't limit sharing their years of expertise to the students in their labs. The two scientists also spread their knowledge of Narragansett Bay with the next generation of marine biologists and oceanographers through a joint seminar on the ecology of the Bay. The spring semester class includes roughly 10 students a year and covers topics from the physics of the Bay to climate change effects to ecosystem management.

As the state of research in Rhode Island continues to evolve and scientists come and go, it's more important than ever for the Ocean State's budding marine researchers to build a strong foundation and to understand the importance of the Bay in our backyard.

For a tribute to the late Dr. Scott Nixon, please see page 2

SURF Student Studies Life Under the Sea in Newport

By: Sara MacSorley

Gina Varuzzo came to Salve Regina University from Turners Falls, MA. It only took one visit for her to fall in love with the school and decide to come study marine and environmental biology on Narragansett Bay.

It was the inspiration of a few special Salve professors, Dr. Sarah Matarese and Dr. Jameson Chace that got Gina interested in doing research. She says that deciding to try research helped her figure out what she wanted to do with her life and was the "best decision [she] ever made."

As someone who learns better by doing, Gina enjoys the hands on field component of research. "I see creatures I normally would only see in textbooks, and I am not sitting in a lab, but am either out on a boat or counting species along the Cliff Walk," she says. She gained new skills she never thought she would have and will be able to use those in her future science career. Or television debut she jokes, "If they ever need help on 'Deadliest Catch,' I'm now a pro at hoisting traps, sexing, sizing, identifying…call me."

For her SURF (Summer Undergraduate Research Fellowship) research, Gina characterized the distribution and abundance of marine invertebrates along Newport Neck, including sites along the Cliff Walk. Marine invertebrates are sensitive to changing ocean temperatures and chemistry *(See Ocean Acidification Explainer, page 15)*. The purpose was to collect baseline data for a five-year climate change report. There is a complementary project researching seabirds since they eat the small invertebrates and are a "reliable indicator of climate change, for they will change their feeding migration in response to an inability to find food," says Gina.

The project is continuing as Gina's senior thesis and she sees the big picture. She hopes her research will "provide numbers that will support the hypothesis that climate change is real, it is happening and affecting Newport, and it is negatively impacting the food supply of local seabirds," she says.

Outreach and education are important to Gina too. She is president of Salve's Environmental Club where they work promoting community awareness of environmental issues, and are currently working on a school-wide ban on water bottles. This relates to her work as a Brita College Ambassador to promote the use of reusable bottles.

When asked about what advice she has for young women interested in science she said: "Science has opened my eyes to so much of what is around me and I find that I have an unquenchable thirst to keep learning. I want to study sharks, something that shocks many people I tell simply because I am a woman. It shouldn't matter what gender you are, if there is something that interests you and makes you happy, do it! Life is so short that I feel you should make the most of it; learn as much as you can, try to save the world. What do you have to lose?"

"…learn as much as you can, try to save the world. What do you have to lose?"

SURF was an experience that helped Gina shape her career as a marine scientist. "I learned so many new skills, including learning to communicate to the general public about my scientific research, to conduct my own research and take on the responsibilities involved with being a lead researcher of a team, and how to work out in the field," she says.

Gina (left in both) and her lab mates collecting and counting marine invertebrates along the shores of Newport.

Gina is now an advocate for undergraduate research experiences because "there is nothing like conducting your own research," she says. "Sitting in a classroom is great to learn background information, but until you are given the opportunity to employ what you have learned, I don't think that you can truly grasp what it means to be a scientist. Hands-on experience is a key to learning, and without it I feel students would miss out on a vital piece of their undergraduate experience."

A future career of marine research seems to be in Gina's future and the skills she learned through SURF will help. She is applying to graduate schools and hopes to study shark ecology and conservation. Ideally, she'd also be studying what sharks have to offer us as people, perhaps a cancer-curing molecule in their tissue. This is Gina's personal mission and tribute to her mother who passed away from cancer in 2003. "What better way to spend my life than combining my two greatest loves: my mother and sharks," she says.

Gina is excited about the possibility of working in the state after graduation. "Rhode Island is so beautiful and has so much to offer, especially for someone like myself who is interested in a field that requires I live near the ocean," she says and we at EPSCoR agree.

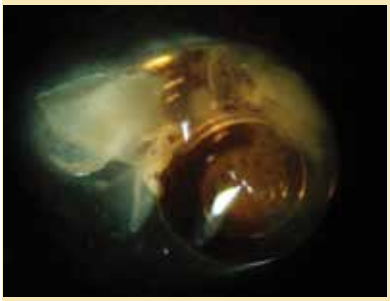
explainer

WHAT IS OCEAN ACIDIFICATION?

Our ocean is becoming more acidic – well technically less basic. Don't worry, you'll still be able to go swimming, but for some smaller ocean organisms this is a huge concern.

The air we breathe is made up of ~75% nitrogen, ~20% oxygen, and small amounts of argon, and carbon dioxide (CO_2). The levels of CO_2 in the atmosphere from human activities like burning of fossil fuels have increased since the start of the Industrial Revolution. The unprecedented rate of increase is a climate change concern.

Phytoplankton provide half of Earth's oxygen and can take in 45 billion tons of CO_2 each year (plants on land take up some too). Some of that carbon is sent to the deep ocean when the plankton die. This is called a natural carbon "sink" and it's important because it keeps the CO_2 out of the atmosphere.



The pteropod, *Limacina helicina*, has a shell that is sensitive to ocean chemistry.

The ocean's natural absorption of CO_2 helps to balance our emissions but another piece of the puzzle involves ocean chemistry. When CO_2 ends up in the ocean it is transformed into carbonic acid. As the amounts of CO_2 in the air have increased so has the acidity of the oceans. This has reduced the pH of the ocean, some estimates say up to 30%.

The changes in pH from about 8.25 to 8.14 may seem slight, even insignificant, but pH is measured on a logarithmic scale. Therefore each pH unit represents an exponential change and these small shifts can have a big impact on marine life and the larger ocean food web.

Some ocean animals take in calcium carbonate from the water to build their shells or other body parts. Calcium carbonate is more likely to become weak or even dissolve as ocean acidity increases. This could affect corals, crustaceans, mollusks, plankton, and others who are sensitive to the acidity changes. The organisms may not be able to adapt to the changes quickly enough to survive.

The greatest changes in pH are expected to occur in the surface waters, where organisms are adapted to a regularly changing environment. Deep-sea creatures however are used to a more stable environment so changes could be devastating.

Plankton are a food source for an ocean of organisms and changes in their abundance would have a domino effect on the rest of the food web. Popular seafood species like lobsters and other shellfish could disappear taking fishermen's livelihoods along with them. Coral reefs are home to a huge biodiversity of marine life, serve as coastal protection from storms, and bring in money as tourist attractions. Ocean acidification has large economic implications and should be a concern for us all.

Imagine crumbling corals and shellfish with no shells. Changing ocean chemistry changes the big picture for the ocean creatures we know and love.

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The Science & Technology Advisory Council ensures fidelity to the Science and Technology Infrastructure Plan (2009) for Rhode Island. One major role of STAC is to be a catalyst for integrating academic research with state priorities and thereby advise on innovation policies that promote economic growth.

Dr. Peter Alfonso is the Director of Rhode Island EPSCoR. He and Dr. Clyde Briant, Vice President for Research at Brown University, serve as Co-Chairs of STAC.

The Steering Committee promotes collaboration, guides research infrastructure development and use, and seeks competitive funding opportunities for Rhode Island's institutes of higher education.

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The Partner Liaisons foster research training of students, communicate to their colleagues the new infrastructure and equipment available, assist in the reporting requirements of NSF, and, ultimately, serve their institutions in developing goals and strategies for continued excellence in student mentoring.

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